National Aeronautics and Space Administration

A 2.7 THz LOCAL OSCILLATOR CHAIN TO ENABLE SPECTROSPOPY FROM A BALLON PLATFORM

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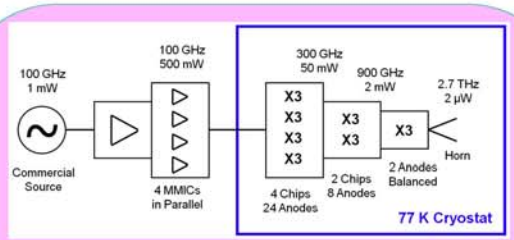
Project Objective: The objective of the proposed task is to design and fabricate a solid state local oscillator chain at 2.7 THz. This chain will enable the University of Arizona to place a HEB based heterodyne receiver channel on an already funded long duration Balloon platform, STO (Stratospheric THz Observatory). This receiver will enable far-infrared spectroscopy of the HD line in the Galaxy. Determining the origin, abundance, and distribution of deuterium (here, traced by HD) is crucial to our understanding of star formation and galaxy building throughout the history of the Universe

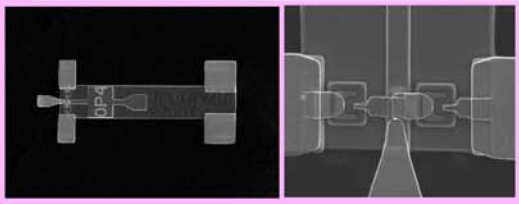
FY08 Results:

1. A quad-chip 300 GHz tripler was designed and fabricated
2. Demonstrated a broadband source in the 260-340 GHz range to be used as a driver
3. A two-chip 900 GHz tripler was designed
4. A credible scheme for obtaining useful power at 2700 GHz has been discussed

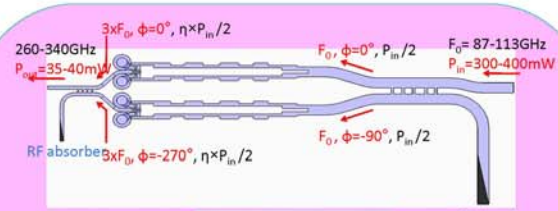
Benefits to NASA and JPL : The highest frequency channel on HIFI (Herschel Space Observatory) is 1.9 THz. The proposed LO chain will enable heterodyne detectors above and beyond what can be accomplished by HIFI. Successful insertion of this technology will allow us to achieve a much higher TRL on this technology which will help immensely to baseline this technology for future missions. The proposed 2.7 THz receiver system will serve as technological demonstrator for future SMEX, MIDEX, and Suborbital proposals. It will help to maintain the unique capabilities of JPL in the rapidly expanding field of THz technology.

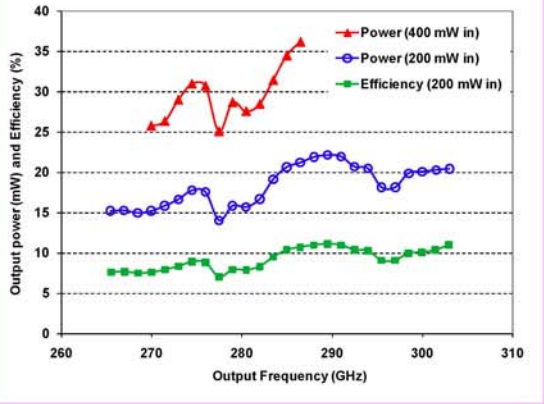
Determining the origin, abundance, and distribution of deuterium (here, traced by HD with the 2.7THz receiver) is crucial to our understanding of star formation and galaxy building throughout the history of the Universe. This is strongly coupled to the strategic challenge of understanding the structure of our Universe.





To generate significant output power multiplier chips will be power combined. The 2.4 THz chip has been designed.





Power combining of multiple chips is utilized to increase input handling power of the multiplier. A 300 GHz quad-chip tripler block and measured results are shown.

Publications:

1. S. Ward, Goutam Chattopadhyay, John Gill, Hamid Javadi, Choonsup Lee, Robert Lin, Alain Maestrini, Frank Maiwald, Imran Mehdi, Erich Schlecht, and Peter Siegel "Tunable Broadband Frequency-Multiplied Terahertz Sources," (Invited Keynote), Proceedings, 33rd International Conference on Infrared, Millimeter, and Terahertz Waves, Pasadena, California, September 2008.
2. Alain Maestrini, John Ward, Goutam Chattopadhyay, Erich Schlecht, John Gill, Choonsup Lee, Hamid Javadi, and Imran Mehdi, "In-Phase Power Combining of Submillimeter-Wave Multipliers," (Invited) Proceedings, 33rd International Conference on Infrared, Millimeter, and Terahertz Waves, Pasadena, California, September 2008.
3. Imran Mehdi, John Ward, Alain Maestrini, Goutam Chattopadhyay, Erich Schlecht and John Gill, "Pushing the Limits of Multiplier-Based Local Oscillator Chains," (Invited) Proceedings of the Nineteenth International Symposium on Space Terahertz Technology, Groningen, Netherlands, April 2008.
4. Maestrini, J. S. Ward, C. Tripon-Canseliet, J. J. Gill, C. Lee, H. Javadi, *G. Chattopadhyay*, and I. Mehdi, "In-Phase Power-Combined Frequency Triplers at 300 GHz," IEEE Microwave and Wireless Components Letters, vol. 18, no. 3 , pp. 218-220, March 2008.

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